New York Space Grant Consortium
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The New York Space Grant Consortium is a Designated Consortium funded at a level of $575,000 (base budget) for fiscal year 2011.

PROGRAM GOALS

The New York Space Grant (NYSG) Consortium aims to inspire, engage, and educate students in science, technology, engineering, and math (STEM) disciplines, and to prepare students across NY State to be the future workforce for NASA and other high-technology industries. The specific SMART objectives tied to the following NYSG consortium goals are listed at the end of the Program Accomplishments section:

NYSG Goal #1: Our NASA Education Outcome 1 programs (Fellowship/Scholarship, Higher Education, and Research Infrastructure) will positively impact the **diversity** of students entering the STEM workforce and pursuing advanced STEM degrees.

NYSG Goal #2: Our NASA Education Outcome 1 programs (Fellowship/Scholarship, Higher Education, and Research Infrastructure) will positively impact the **number** of students entering the STEM workforce and pursuing advanced STEM degrees.

NYSG Goal #3: Our consortium will help build NY State higher education-industry collaborations, while assisting with high technology workforce development to decrease the "brain drain" afflicting NY State.

NYSG Goal #4: Our NASA Education Outcome 2 (Precollege Education) programs will attract and retain students in STEM disciplines though K-12 teacher professional development and K-12 student opportunities.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

Examples of NYSG benefits to Outcome 1 (Fellowship/Scholarship and Higher Education):

A NY Space Grant fellowship has been extremely important to a female African-American graduate student's success in the physics PhD program at Rensselaer Polytechnic Institute. After struggling upon arrival in graduate school, she was able to take an extra year of coursework thanks to Space Grant support, which allowed her to excel with a 4.0 GPA in the fall 2011 semester. She will earn an MS in physics in May 2012 and is well on her way to attaining her PhD.

An undergraduate student that NYSG sponsored for a summer 2008 internship at NASA Kennedy Space Center is now working as an engineer for the US government. He provided the following feedback in his longitudinal tracking response: "When I received the grant [from NY Space Grant], I was finishing up my freshman year at Cornell and unsure of my future path. When I applied to Cornell, I thought that I would study mechanical engineering but wasn't sure I liked it and had been considering changing majors to a social science. That summer, because of Space Grant, I worked at Cape Canaveral and had a wonderful experience. I knew then that I wanted to pursue a degree in STEM, so I joined the Applied and Engineering Physics program, which was a perfect fit for me. …the experience I had and people I met from that summer helped me into another internship program, again with the US government. That internship turned into a job where I am currently employed. Space Grant provided a chance for me to be exposed to the life of an engineer and I found that I loved it. Had it not been for the grant, I possibly would not have realized my passion for STEM, probably would not have pursued a STEM major, and certainly would not be employed in the STEM position [I currently hold]. I would describe the Space Grant and summer with NASA as a major turning point in my career and life. I am very grateful of the opportunity I was given."

Through NYSG, a Union College female was given opportunities to conduct hands-on, faculty-mentored research as a freshman and attend a professional conference. Both have been life-changing experiences for her. She writes that attending the Materials Research Society Fall 2011 Meeting "was one of the best experiences I've had at Union College and has profoundly influenced my academic track. I was able to network and make connections with other researchers/professors at various prestigious institutions. From conversing with various professors and masters/PhD students, I have gathered a more realistic view of what graduate school is like. I also have a clearer idea of what I would like to do in regards to graduate school. In addition to networking, I have gained a much more thorough understanding of my research."

Example of NYSG benefits to Outcome 2 (Precollege):
NYSG supported the first-ever Syracuse Regional VEX Robotics Competition, held at the Museum of Science and Technology (MOST) in February 2012. Twenty-nine teams from Central NY middle and high schools participated; approximately 50% of the team members were females or underrepresented minorities. By working with teachers/mentors and their teammates on building amazing robots, students learned many academic and life skills. Two of the teams advanced to the northeast regional event, and two signed up to compete in the world championships to be held in Anaheim, CA.

Example of NYSG benefits to Outcome 3 (Informal Education):
Sciencenter staff worked with ten minority middle school students from the Greater Ithaca Activities Center on a special program to design and build exhibits that demonstrate physics and other scientific principles. These student-built exhibits were then displayed at the Sciencenter to engage visitors in hands-on science learning. The participants and their families attended a showcase event to celebrate their achievements.

PROGRAM ACCOMPLISHMENTS

Outcome 1 [Fellowship/Scholarship, Higher Education, and Research Infrastructure programs] – Many opportunities to develop the STEM workforce in disciplines needed to achieve NASA's strategic goals were provided with FY2011 Base funds. NYSG-funded undergraduate and graduate students conducted a wide array of STEM research and projects (e.g., aeronautical, biomedical, electrical, and mechanical engineering; computer science/engineering; atmospheric and environmental sciences; physics; astronomy and space sciences; human factors/telerobotics; mechatronics/robotics; and optics) during the academic year and summer at **all** NYSG colleges/universities. Many students were involved in analyzing data from NASA telescopes such as Chandra, Fermi, Hubble, Solar Dynamics Observatory, Spitzer, STEREO, and WISE. Students from Barnard College and SUNY Geneseo presented their research at the January 2012 American Astronomical Society meeting. NYSG also supported student travel to conduct research (e.g., Kitt Peak National Observatory) and participate in various conferences (e.g., SpaceVision 2011, National Space Grant meeting, and National Space Symposium).

Medgar Evers College continued its high altitude balloon and CubeSat programs, the latter of which awaits a launch re-manifest. These two programs provided immense hands-on experiences for underrepresented minority students, who ran an ozone-monitoring project (no longer involved in the student-run ozonesonde preparation and launches, faculty mentors provided students with background scientific information and data analysis training), and solved real-world problems in the design and assembly of the CUNYSAT-1 CubeSat for a NASA launch. MEC and Cornell students assisted Rensselaer Polytechnic Institute students with launching their first payload as part of a new RPI BalloonSat program. This joint launch occurred on July 23, 2011 at MEC's balloon launch base in Paradox, NY; the RPI payload was successfully recovered after landing near Lebanon, NH. Ten students, from eight different NYSG institutions, were sponsored for summer 2011 NASA internships and NASA Academies at Ames, Jet Propulsion Laboratory, Goddard, Langley, and Marshall. Two engineering students

participated in the ongoing summer internship program NYSG established with Moog Space and Defense in western NY, one funded by NYSG and the other by Moog. The Sciencenter recruited and trained five pre-service teachers (undergraduate and masters students) for summer camp hands-on science teaching.

Outcome 2 [Precollege] – Space Grant-supported NYU-Poly graduate students helped New York City-area secondary school teachers learn mechatronics and robotics concepts in efforts to integrate hands-on engineering activities into the teachers' classrooms. NYSG funds supported the Buffalo Engineering Awareness for Minorities (BEAM) summer program, in which post-10th and 11th grade minority students took mini-courses in math, engineering, and computer science in addition to working on 7 of the 14 National Academies of Engineering Grand Challenges for the 21st Century. BEAM students also visited many SUNY Buffalo research labs, and five of them conducted research projects with guidance from SUNY Buffalo engineering and computer science professors. The 2011 Central NY Rocket Team Challenge, run by the Museum of Science and Technology (MOST) and Syracuse University, included Spring 2011 workshops for teachers and students, rocket science lectures, and culminated in the Saturday, June 4 launch day. A record 117 teams participated in this activity (a total of 585 students, a 30% increase over 2010), representing 35 different school districts. MOST and Syracuse also ran their annual Bridge Build'em and Bust'em event in November 2011, in which 201 teams of 4th through 12th grade students built bridge structures and brought them in for stress testing by science/engineering professionals. Twenty-nine student teams from Central NY competed in the inaugural Syracuse Regional VEX Robotics competition, held at MOST in February 2012. NYSG and MOST also supported a STEM Careers Event for 130 high school students and teachers (March 2012) and the Central NY Regional Science Fair in which 244 middle and high school students participated (April 2012). Six teams of high school teachers and students from the NY Capital District participated in Union College's Physics Constants Workshop in December 2011, working on physics experiments that introduced students to instrumentation and techniques that are not available in high schools.

Outcome 3 [Informal Education] – Alfred University's Space Grant students conducted open-house events at the Stull Observatory, attracting 150-200 people including many younger children. Columbia University continued its very active astronomy outreach programs in the NYC area, including a widely attended public lecture and stargazing series, astronomy-themed science fiction movie screenings accompanied by discussions of accurate & inaccurate science portrayed in the films, *Family Astro* events, a *Sidewalk Astronomy* program in Harlem, and a public stargazing event in the Brooklyn Bridge Park as part of the World Science Festival. More than 4200 members of the public attended Columbia's various outreach events. Upon request, the NYU-Poly affiliate director and NYSG-supported students presented an interactive LEGO Mindstorms exhibit "Mechatronics Mania" at NASA's August 2011 "What's Your Favorite Space?" public expo in NYC. NYSG also sponsored a special opportunity for a dozen FIRST Robotics NYC-area students to meet and interact with STS-135 astronauts who attended this expo. The Sciencenter provided Community Science Nights at local and regional elementary schools, which included hands-on science activities for children to take home, and

presented StarLab interactive astronomy programming to preschool through high school students in a variety of settings. Sciencenter staff also provided afterschool science programming at a local elementary school, and worked with minority middle school students on a special program to design and build exhibits that demonstrate physics and other scientific principles. These exhibits were then displayed at the Sciencenter to engage visitors in hands-on science learning; the students and their families attended a showcase event to celebrate their achievements.

The New York Space Grant Consortium made the following progress towards meeting its SMART goals/objectives:

1. The percentage of NYSG underrepresented minority student awardees (monetary and non-monetary) per budget year shall meet or exceed the adjusted minority enrollment percentage in NY higher education institutions (26.6%). The percentage of underrepresented minority students participating in fellowship/scholarship, higher education, and research infrastructure programs (from FY2011 base funds) was 29%.
2. The percentage of NYSG female student awardees (monetary and non-monetary) per budget year shall meet or exceed 38% (based on STEM bachelor's degrees awarded to females nationwide). The percentage of female students participating in fellowship/scholarship, higher education, and research infrastructure projects (from FY2011 base funds) was 38%.
3. NYSG shall strive for 90% or more of graduating significant awardees to take the next step to STEM employment or advanced STEM degrees. Based on longitudinal tracking data, of the 3 significant awardees (from FY2011 base funds) who have graduated since their involvement in NYSG programs, 2 are pursuing advanced STEM degrees while 1 is seeking STEM employment.
4. NYSG shall add 2-3 more industrial affiliates in New York State by the end of the 2010-2015 grant period. We are making progress toward this objective, as we engaged two more companies (Moog Space and Defense, and Honeybee Robotics) in providing NASA-related summer 2011 internships for NYSG students.
5. Following their involvement in NYSG precollege programs, at least 75% of K-12 teachers participating in long-duration (≥2 days) training will utilize NASA resources in their classroom instruction. Teachers that researched and learned about mechatronics and robotics from NYSG-supported NYU-Poly students are in the process of integrating concepts they learned within their classrooms.
6. Following their involvement in NYSG precollege programs, at least 60% of K-12 teachers participating in short-duration training will utilize NASA resources in their classroom instruction. Teachers that participated in Union College's Physics Constants Workshop have passed along the excitement and new experiences/knowledge they gained to students in their classrooms.
7. Following their involvement in NYSG precollege programs, at least 50% of K-12 students will express interest in STEM careers. A majority of the students that participated in precollege programs (e.g., BEAM, Central NY Rocket Team Challenge, Bridge Build'em and Bust'em, VEX Robotics) have shown interest in STEM careers, as tracked by the BEAM program administrators and students' repeated participation in STEM competitions.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Student Data and Longitudinal Tracking: Total student participants in FY2011 Base funding programs = 97 (Fellowship/Scholarship = 37, Higher Education/Research Infrastructure = 60). Out of the total participants, 28 were underrepresented minorities (29%) and 37 were female (38%). Of the total participants, 56 students received significant awards, of which 2 are pursing advanced STEM degrees, 1 is seeking STEM employment, and the remaining 53 students are still enrolled.

- Diversity: The NY Space Grant Consortium involves a wide variety of institutions (higher education, informal education, and industry), spread throughout upstate NY and the New York City area, with faculty from many different STEM fields serving as affiliate directors. College/university students that participated in NYSG FY2011 Base-funded programs were 29% underrepresented minorities and 38% female.

- Minority-Serving Institutions: Three NYSG affiliates are minority-serving institutions: CUNY City College of New York, CUNY Medgar Evers College, and CUNY York College. While SUNY Stony Brook is not a minority institution, NYSG is partnered with its Louis Stokes Alliance for Minority Participation (LSAMP) program to provide underrepresented minorities with NASA-related research opportunities with Stony Brook faculty. Additionally, Medgar Evers College has ongoing collaborations with out-of-state minority-serving institutions, such as University of Houston-Downtown and South Carolina State University.

- NASA Education Priorities:
  With FY2011 Base funding, NYSG programs contributed to the following priorities *[italicized]* identified by NASA:

  - *Authentic, hands-on student experiences in science and engineering disciplines:* NY students benefited from STEM research and internship opportunities at all NYSG affiliate institutions, NASA centers, and Moog Space and Defense. Medgar Evers College involved predominantly underrepresented minority students in hands-on high altitude balloon and CubeSat projects. Secondary school students gained hands-on experience with STEM projects and research through NYSG-supported programs such as BEAM, Central NY Rocket Team Challenge, Bridge Build'em and Bust'em, VEX Robotics, etc.
  - *Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise:* NYC-area middle school teachers were aided by NYU-Poly Space Grant students in learning mechatronics and robotics concepts, in efforts to integrate hands-on engineering activities into the teachers' classrooms.
  - *Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers:* Alfred University runs a residential summer astronomy institute that

helps recruit high school students into STEM disciplines; NYSG-funded undergraduates assisted with this institute by running hands-on lab activities and serving as young adult role models. The Buffalo-area Engineering Awareness for Minorities (BEAM) program engaged post-10th and 11th grade minority students in faculty-mentored engineering and computer science projects at SUNY Buffalo.

- *Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges:* The Clarkson University NYSG affiliate director has developed a new relationship with a rural community college, acting as an advisor to a faculty member in mechanical engineering technology. Nearby CUNY community colleges have been involved with the CubeSat program led by Medgar Evers College.
- *Aeronautics research – research in traditional aeronautics disciplines, areas appropriate to NASA's unique capabilities, and needs of the Next Generation Air Transportation System (NextGen):* Space Grant-supported research at Clarkson included mico-air vehicles and inflatable UAVs. A NASA Langley summer intern sponsored by NYSG worked on finite element models for analyzing load-bearing characteristics of structural components on Hybrid-Wing Body aircraft.
- *Environmental Science and Global Climate Change – research and activities to better understand Earth's environments:* Clarkson University students aided faculty in designing and fabricating a UAV to be used to investigate atmospheric and environmental problems. Students in Medgar Evers College's high altitude balloon program were involved in NYC-area ozone research. At the National Weather Service sounding facility in Brookhaven, NY, MEC students calibrated, tested, and launched ozonesondes, then retrieved and analyzed the resulting data. The Sciencenter incorporated its Climate Change Toolkit into its pre-service teacher summer training program. Syracuse University students conducted research in environmental sciences, including analysis of sulfur deposition within Adirondack Park forests, and the recovery of forest lands from chronic acidification. As part of a long-term environmental study of pollutants, a Union College student utilized a particle accelerator and ion-beam analysis techniques to determine the elemental composition and concentration of rainwater and snow samples as functions of time and location.
- *Diversity of institutions, faculty, and student participants:* The NY Space Grant Consortium involves a wide variety of institutions (higher education, informal education, and industry), spread throughout upstate NY and the New York City area, with faculty from many different STEM fields serving as affiliate directors. College/university students that participated in NYSG FY2011 Base-funded programs were 29% underrepresented minorities and 38% female.

IMPROVEMENTS MADE IN THE PAST YEAR

NYSG increased its STEM precollege programming through Syracuse University and the Museum of Science and Technology, with particular emphasis on increased recruitment/participation of underrepresented students in STEM (females and minorities)

from the urban school districts surrounding Syracuse. Columbia University and the Sciencenter increased informal education programming, also with emphasis on underrepresented groups, in the New York City and Ithaca areas, respectively. NYSG has strengthened its relationship with the NY State Education Department, and has offered to collaborate with the department on development of Next Generation Science Standards (a multi-state effort to improve science education for all students). Last but not least, collaboration within our consortium has increased. For example, during summer 2011 experienced students from Cornell's nanosatellite team worked with Medgar Evers College (MEC) students on CUNYSAT-1, and MEC and Cornell students helped Rensselaer Polytechnic Institute students launch their first BalloonSat in July 2011.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

1. **Alfred University**, Alfred, NY *[highly residential, Master's I, private]* undergraduate research and F/S, informal education
2. **Barnard College**, New York, NY *[highly residential, Baccalaureate - Liberal Arts, private]* **liberal arts college for women,** undergraduate research and F/S
3. **CUNY City College of NY**, New York, NY *[primarily nonresidential, Master's I, public]* **Minority Serving Institution,** graduate research and F/S
4. **CUNY Medgar Evers College**, Brooklyn, NY *[primarily nonresidential, Baccalaureate - General, public]* **Minority Serving Institution,** undergraduate research and F/S, student balloon (MECSAT) and CubeSat (CUNYSAT) programs
5. **CUNY York College**, Jamaica, NY *[primarily nonresidential, Baccalaureate - General, public]* **Minority Serving Institution,** undergraduate research and F/S
6. **Clarkson University**, Potsdam, NY *[highly residential, Doctoral/Research - Intensive, private]* undergraduate and graduate research and F/S
7. **Colgate University**, Hamilton, NY *[highly residential, Baccalaureate - Liberal Arts, private]* undergraduate research and F/S, informal education
8. **Columbia University**, New York, NY *[highly residential, Doctoral/Research - Extensive, private]* graduate research and F/S, informal education
9. **Cornell University**, Ithaca, NY *[primarily residential, Doctoral/Research - Extensive, private and public (land grant)]* **NYSG lead institution**, undergraduate and graduate research and F/S, other consortium-wide projects such as summer internship programs, precollege, and informal education
10. **Lockheed Martin**, Owego, NY – Aerospace industry affiliate providing student internships.
11. **Polytechnic Institute of New York University (NYU-Poly)**, Brooklyn, NY *[primarily nonresidential, Doctoral/Research - Intensive, private]* undergraduate and graduate research and F/S, precollege

12. **Rensselaer Polytechnic Institute**, Troy, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate and graduate research and F/S
13. **Rochester Institute of Technology**, Rochester, NY *[highly residential, Master's I, private]* graduate research and F/S
14. **Sciencenter**, Ithaca, NY – Non-profit informal education affiliate, precollege and undergraduate training
15. **SUNY Binghamton**, Binghamton, NY *[highly residential, Doctoral/Research – Extensive, public]* undergraduate research and F/S
16. **SUNY Buffalo**, Buffalo, NY *[primarily residential, Doctoral/Research - Extensive, public]* graduate research and F/S, precollege
17. **SUNY Geneseo**, Geneseo, NY *[highly residential, Master's I, public]* undergraduate research and F/S
18. **SUNY Stony Brook**, Stony Brook, NY *[highly residential, Doctoral/Research - Extensive, public]* **NYSG is partnered with the LSAMP program which runs minority-focused projects,** undergraduate research and F/S
19. **Syracuse University**, Syracuse, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate research and F/S, precollege and informal education projects with the Museum of Science and Technology (MOST) in Syracuse
20. **Union College**, Schenectady, NY *[highly residential, Baccalaureate - Liberal Arts, private]* undergraduate research and F/S, precollege
21. **University of Rochester**, Rochester, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate and graduate research and F/S